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Bruce Halstead
U.S. Fish and Wildlife Service
1125 16th Street, Room 209
Arcata, CA 95521

Re: The Habitat Conservation Plan and Environmental Impact Report for the Incidental Take Permit (ITP) application by Pacific Lumber Company, Headwaters Forest

November 16, 1998

Dear Mr. Halstead,

The following is my comment on the HCP and EIR prepared to justify the issuance of an ITP to Pacific Lumber Company (hereafter referred to as the PALCO HCP). I am qualified to comment on the scientific standards that should have been applied to the HCP and EIR. My CV is attached, along with copies of the references I cited in the following comment letter.

Sincerely,

Shawn Smallwood

Shawn Smallwood

COPY

Comment on the Pacific Lumber Company HCP and EIR

The HCP is becoming a popular application of the Endangered Species Act (ESA) of 1973 (16 U.S.C. §§ 1531-1544 (1988)), and along with other Agreements, involve issuance of permits for incidental take. Environmental Impact Statements (EISs) are developed to comply with the National Environmental Protection Act and there are similar documents required by state governments. The environmental consulting industry has developed many of the EA, EIS, and HCP documents, and the US Fish and Wildlife Service and the National Marine Fisheries Service (hereinafter referred to as the Services) have developed some as well. Although there are federal guidelines for the ESA applications (Services 1996), the confusion and inconsistency has been impressive. Except for listings and funding allocations, the struggles over ESA applications have centered on the scientific rationale for making any of the following conclusions: (1) whether the proposed project will significantly reduce the likelihood of survival and recovery of species in the wild ; (2) the extent or magnitude of the impacts; and (3) the type and extent of impact avoidance or mitigation to be implemented. The scientific rationale for these conclusions largely determines the ESA effectiveness and credibility. This rationale also bears on the integrity of modern environmental science, due process under the law, and the public trust.

Pragmatism and political trade-off should follow rather than precede the use of the best scientific information in making "take" decisions. The intent of the ESA is clear enough, although its translation into modern scientific standards and enforceable statutes requires consideration by trained environmental scientists. I will use my scientific experience with ESA documentation to interpret the ESA's intent as enforceable rules for the use of science in preparing ESA compliance documentation for take decisions.

I will first describe each of the modern scientific standards that are applicable to the take decision regarding the PALCO HCP. Then I will assess whether these standards were met by Pacific Lumber Co. The standards I will describe are those that would apply to implement the intent of the ESA using current scientific principles and methods. They are applicable to other environmental compliance issues, although regulations vary in specific wording. No matter how politics influences the language of these environmental laws, the best scientific data should be used for assessing impacts and mitigation effectiveness of the PALCO HCP (National Research Council 1995).

Science Applied to the ESA

The demanding intent of the ESA was amply demonstrated in several of its phrases. For example, the direct and incidental taking of threatened and endangered species shall not appreciably reduce the likelihood of their survival and recovery in the wild (Sections 7(a)(2) and 10(a)(2)(B)). Federal agencies are supposed to demonstrate that their actions and consultations are not likely to jeopardize the continued existence of threatened and endangered species (Section 7(a)(2)). To this end, the best scientific data are to be used (Section 7(a)(2)). Furthermore, the take permit applicant and the Services need to assess the proposed project's impact on the risks to the survival and recovery of the species (Section 10(a)(2)(A)(i)). The risk assessments must not be limited to the defined project area, because Section 4(a)(3)(A) of the ESA requires the designation of critical habitat inside and outside the species range of distribution at the time of listing. The purpose of the ESA is to conserve the ecosystem upon which the threatened and endangered species depend (Section 2(b)). Therefore, the intent of the ESA is to assess the likely project impact on the species by including the larger spatial and systemic context in which the species exists, and should include a cumulative impact assessment.

ESA's Sections 2(c)(1) and 7(a)(1) declared Congressional policy to be that all federal agencies use their authorities to conserve listed species. The ESA defined conservation as the use of all methods and procedures necessary to recover listed species, including use of scientific resources management and research. Science was put at the core of the ESA statutory scheme. Science is a structured process by which humans gain understanding of nature (Popper 1969, Kuhn 1970). It includes testing hypotheses in an attempt to refute conjectures generated by previous experience and theory, and it includes a methodology for dealing with uncertainty. Given the structure of science, scientific assessments of impacts and risks due to proposed take also require scientific monitoring plans integrated with adaptive management strategies.

Implementing the ESA's intent of using the best scientific data requires several other standards, as well as a basic understanding and use of the scientific method. Scientific data are meaningless without proper use and interpretation by scientists. The data need scientific evaluation of their limitations and uncertainties, and their interpretation requires existing theory and method. Congress certainly did not intend that ESA decisions should use bad science to interpret data. Therefore, the best scientific data are those codified into scientific theory and based on use of the best scientific methods.

To meet the intended use of science in the ESA, take decisions, such as the proposed PALCO HCP/ITP, should be made only after designating critical habitat, assessing risks for populations and their supporting ecosystems, detailing a scientifically founded adaptive management plan with an integrated monitoring program, conducting uncertainty analyses, properly referencing source data and analytical methods, and undergoing independent scientific review. The National Research Council (1995) also recommended risk assessment and uncertainty analysis, and the federal HCP guidelines (Services 1996) also advocate adaptive management integrated with scientific monitoring. In the following section, I will describe eight standards that should be applied based on the language in the Endangered Species Act. After describing each standard, I then assess PALCO's HCP for compliance.

Standard 1 -- Identify and Designate Critical Habitat

Although Habitat Conservation Plans are really mitigation plans, the habitat concept is central to any reasonable attempt by those preparing HCPs to assess the impacts of take and the likely success of proposed mitigation or avoidance measures. Habitats are defined by the species' use of the environment, and therefore use and availability of environmental resources must be considered (Smallwood 1993, Morrison et al. 1992). Vegetation and soil types are not habitat unless they can be directly linked as resources required by a particular species (Hall et al. 1997). Resource patch structure varies among spatial scales of observation (Kotlier and Wiens 1990, Levin 1992), so spatial scale of observation can influence interpretation of habitat, because as the scale of observation changes, our measures of availability and use likely also change (Smallwood 1995, Riitters et al. 1997). Therefore, multiple spatial and temporal scales need consideration for identifying and designating critical habitat.

Critical habitat was not defined explicitly in the ESA, although examples were provided (also see Services 1996). Bogert (1994) interpreted ESA's critical habitat as the geographic area occupied by a species at the time of its listing, as well as areas outside the range that are essential to the conservation of the species. This critical habitat definition erroneously assumes species are statically distributed only at places where their populations can persist. The National Research Council (1995) corrected this misinterpretation of critical habitat, but they misused the terms "habitat" and "critical habitat" as consisting of particular vegetation types. Hall et al. (1997) clarified the situation by defining critical habitat as areas that can provide resources for population persistence, consistent with the concept of high-quality habitat. Therefore, not only does a species' preference for available environmental elements require quantification, but reproductive success also needs to be linked to the preferred environmental elements before they are designated critical habitat. Most listed species lack scientifically founded critical habitat designations (National Research Council 1995, Gordon et al. 1997).

Knowledge of habitat for legally rare species is usually limited to primarily qualitative, natural history observations. Such observations are indeed important, but inadequate for reducing the uncertainty as to which condition is preferable among those claimed by multiple naturalists. The strongest scientific foundation for designating critical habitat is the scientific field experiment. Such experiments can be mensurative or manipulative (*sensu* Hurlbert 1984). Mensurative experiments involve counts of species' individuals or their signs along with each environmental resource thought to possibly comprise habitat. These counts are then related to the availability in the sampled landscape of environmental elements that might be habitat. Manipulative experiments involve replication and interspersion of multiple sets of environmental conditions that possibly serve as habitat. Such experiments can help reduce the uncertainty in critical habitat designations, and should be built into adaptive management whenever ITPs are to be issued without waiting for adequate habitat analysis.

Attempting to demonstrate rigor in habitat designation, many GIS maps of vegetation types and other environmental variables have been presented to the public in support of HCPs. These maps usually look impressive, but are often flawed with inappropriate categorization (e.g., "habitat types" rather than vegetation complexes), data aggregation at scales too coarse for the intended analysis, inaccuracy, and inappropriately hard ecological boundaries (Rejesky 1993). It is also important not to carelessly replace the terms "vegetation" and "vegetation type" with "habitat" or "habitat type," because such replacement is inappropriate (Hall et al. 1997), and the wording has ramifications for land-use decisions and policy (Rejesky 1993). The "habitat" depicted in a GIS map may not be the critical habitat that still needs to be identified and designated for ESA compliance.

How was Habitat dealt with in the PALCO HCP and EIR?

The PALCO HCP defined habitat from timber stand types used in mapping for the purpose of the SYP. Habitat was defined from vegetation categories convenient for GIS-based model projections of timber harvesting under the SYP, rather than being defined from the species' weighted use of the environment. No use and availability analyses were performed for any of the species except for non-PALCO studies on Northern Spotted Owls. However all list A & B species should have been analyzed for habitat designation because species included on the ITP are to be treated as legally Threatened or Endangered (Federal guidelines on HCPs, Services 1996). The term habitat was used incorrectly throughout the HCP and EIR, and this incorrect usage affected the conclusions regarding impacts and mitigation effectiveness. This flawed use of the term habitat also invalidated the comparison of project alternatives in the EIR. SS-1

Furthermore, the habitat guilds defined in the Palco HCP were scientifically nonsensical. Guilds can be identified through common use of specific ecological resources, but no two species share the same habitat, due to the ecological exclusion principle. The guilds portrayed in the HCP should have been termed as "species assemblages associated with PALCO's SYP map categories." SS-2

However, these species assemblages ("Habitat Guilds") were inappropriate for a number of reasons. First, the Marbled Murrelet was placed alone in its own guild, as if it so relies on PALCO'S definition of Old Growth Habitat that it has nothing in common with the species assemblage in PALCO's Late Seral Habitat. I wonder whether Marbled Murrelet was placed in its own guild based on the 1995 monitoring study. According to page 7 of the Multiple Species Monitoring Study, the data collected were subjected to cluster analysis to identify the habitat guilds, but according to the information on page 28, SS-3 the Marbled Murrelet was not even detected in the multi-species monitoring efforts. Apparently, a separate, unstated method was used to assign Marbled Murrelet to its own guild, thus giving me the impression that the Old Growth Habitat Guild was designed to justify the MMCAs and the extensive take of Late Seral Habitat. But then, how are the other Habitat Guilds being conserved within the MMCAs if they are so different from Marbled Murrelet? SS-3 CONT.

A second problem with the Habitat Guilds lies with the methods used to construct them. The sampling methods used in 1995 were of low rigor, involving casual observations, 3 x 20-minute bird counts per plot, pit-fall traps for herpatofauna, and trailmaster camera setups for species of Carnivora. These methods were inadequate for detecting rare species and many nocturnal species such as owls and bats. Of greater concern to me, the sampling plots were distributed within 3 areas that were chosen arbitrarily, and corresponding, perhaps conveniently, with existing paved roads (Map 8). Such plot locations failed to correspond with scientific monitoring protocols (Morrison and Marcot 1995). Also, the plots within selected areas did not appear random, contrary to the claim made in the HCP. SS-4

A third problem with the Habitat Guilds and the Habitats is the hard boundaries separating them in the GIS maps. Viewing the GIS maps, one might get the impression that species assigned to a particular habitat might suddenly stop and turn back when they encounter the boundaries between the Habitats. This representation of boundaries, coupled with the PALCO distinction between the Old Growth and Late Seral Habitats, has ramifications for the comparison of alternative project actions. PALCO qualified Late Seral Habitat as being different from Old Growth based on Late Seral Habitat having been subjected to some unstated level of management (EIR pages 3.9-17 & 3.10-22). PALCO's distinction between Old Growth and Late Seral Habitats appears to have been unique (EIR page 3.10-21), lacking any scientific foundation. Whatever levels of management were ever actually applied to qualify a forest tract as Late Seral, the bright, contrasting colors in Map 5 give the appearance that these arbitrarily separated forest conditions are very different from each other, when they likely are much more similar than different. SS-5

The hard boundaries between the PALCO Habitats do not reflect the uses of the environment made by most biological species, except when they face boundaries such as between late seral forests and clearcuts or human settlements. For example, the so-called nesting quality of current Northern Spotted Owl habitat (Map 15) matched poorly with the 1997 Owl site locations (Map 27). Although I am uncertain as to how PALCO defined nesting quality habitat, its mapping on GIS obviously failed to represent reality, leaving plenty of room for damaging surprises. Hard boundaries also do not reflect on the boundary conditions of many ecological processes (Margalef 1963). SS-6

Another problem in PALCO's habitat mapping is that it was based on 1986 aerial photos (EIR page 3.9-1), which in my opinion, were too old. Also, the PALCO habitat delineations were cross-walked with the California Department of Fish and Game's WHR data base, which is also inappropriate for designating habitat of species (Morrison et al. 1992). SS-7

The HCP focused on priority habitat types identified by priority species (EIR page 3.10-18), although I am not familiar with the term priority habitats (I have not seen it in the scientific literature). The mitigation for most of the List A & B species was equivalent with that proposed for Marbled Murrelet under the preferred project alternative (HCP vol. IV, Section F). Apparently, PALCO considered Marbled Murrelet to be the "umbrella" species, which was intended by Wilcox (1984) to be a carefully chosen species broadly representing the ecological resource needs of a certain assemblage of other species. However, PALCO chose Marbled Murrelet to be its umbrella species not because it was representative of any other species, and it was not according to the Habitat Guilds, but because of its SS-8 listing status (EIR page 3.10-18). The choice of Marbled Murrelet as the umbrella species was not based on ecological methods or any tenets of Conservation Biology. Focus on a single umbrella species will likely fail to protect many other species native to the same area (Launer and Murphy 1994). Relying on MMCAs to conserve most of the other List A & B species was inappropriate and would likely result in significant adverse impacts. SS-8 CONT.

PALCO defined interior forest as those Late Seral Habitat areas at least 400' from the edge of the Habitat patch. Despite documented edge effects of 600-800' (EIR page 3.10-28), 400' was chosen to characterize interior forest conditions from the perspective of the Marbled Murrelet (EIR page 3.10-28). Thus, interior forest was mapped and assessed for levels of habitat fragmentation, but only for the Marbled Murrelet. It was inappropriate to use this same distance threshold for identifying the edge effects on all the List A & B species (also see Kelly and Rotenberry 1993). Furthermore, the EIR (page 3.10-20) defined habitat fragmentation in a manner that was inconsistent with the scientific literature. The term connectivity was integrated into the definition, but was also linked to forested riparian buffer strips. In my opinion, the term habitat fragmentation was used inappropriately in this HCP and EIR, and might have given some readers the perception that the landscape resulting from extensive clearcutting will be of greater functional value to wildlife than is possible. Habitat fragmentation was not measured or assessed in any scientifically accepted manner. SS-9

It was unnecessary for PALCO to use the umbrella species concept for its planning purposes. Such ecological shortcuts lack empirical foundation for their effectiveness (Simberloff 1998), and Smallwood et al. (1998) demonstrated how all the 29 target species proposed for inclusion on the Yolo County HCP/ITP can be used to identify priority mitigation sites. Smallwood et al. (1998) developed a practical method for including the major ecological resource needs of all the target species in the HCP. There was no excuse for PALCO to use Marbled Murrelet as an umbrella species. SS-10

Standard 2 -- Risk Assessment based on Impact Estimate(s)

Population Viability Analysis (PVA) is a relevant risk assessment method for environmental documents such as EISs and HCPs. PVA is a flexible approach to estimating time to extinction, probability of extinction by a given date or period of time, probability of persistence, and minimum viable population size for persistence (Boyce 1992). All of these estimates have corresponding error rates or uncertainty ranges, because their parameter values are founded on assumptions with implicit uncertainty. The negative version of PVA is population vulnerability analysis, which is more appropriate for assessing whether mitigation will comply with the ESA recovery standard. Until 1992, PVA had been applied to 35 species (Boyce 1992), and has been applied numerous times since then. It is growing in acceptance among ecologists and conservation biologists, and is intended for use with rare, vulnerable species. Connell and Sousa (1983) recommended that the minimum area be estimated for population or community persistence, and Schonewald and Buechner (1991) furthered this recommendation by providing methodology to do so. Soule (1991) recommended a viability analysis be performed for nature reserves. Gilpin (1996) recommended geo-referencing the population data used in PVA. All these recommended variations of PVA would provide useful risk assessments, so long as the appropriate high-quality data are collected and used.

Environmental documents rarely make use of the necessary data for PVA, including estimates of abundance and abundance patterns through time and space, reproductive rates, survival rates, dispersal distances, and in some cases, genetic variability. Even quantitative impact assessments are rarely provided. Without use of these data, scientifically defensible PVAs are impossible, so the risk to survival and recovery of species due to project impacts would not be assessed using all the methods available to the Services, as per ESA Sections 2(c)(1) and 7(a)(1).

The PVA parameter values are especially relevant to assessing extinction risk in the face of declining habitat space available for the listed species (Shaffer 1981). Based on the theoretical foundations of ecology and the tenets of conservation biology (MacArthur and Wilson 1967, Soule and Wilcox 1980, Verner et al. 1992), ecological space is one of the most important resources for all the listed species. Habitat fragmentation, which is the physical restructuring of the landscape producing habitat patches of smaller average size and greater average separation (Wilcox and Murphy 1985), is the principal threat to species conservation. Without a full-scale PVA, to conclude the listed species are not in jeopardy of extinction due to the level of take proposed in many HCPs is to ignore scientific knowledge. Such conclusions are unscientific when made with no empirical evidence to support them, and give the impression they were driven by a process other than environmental science. The existing uncertainty in the parameter values used for PVA will be exacerbated as ecological space and spatial contiguity are lost due to project take and cumulative impacts. Space and contiguity of habitat influence many aspects of species' natural history, population dynamics, genetics, as well as the impacts of environmental stochasticity (Wilcox and Murphy 1985, Morrison et al. 1992).

Aerial reduction due to project take can translate to reductions in species distributions and abundance within the planning area. Wide geographic distribution appears to be critical for the persistence of rare species (Goodman 1987), so reduced geographic ranges of rare species may contribute significantly to cumulative impacts. Without careful analysis of the nature of the aerial reduction, the planners would be prudent to assume, as a starting point, at least a proportional reduction in distribution and abundance along with aerial reduction. Time to extinction decreases with smaller spatial areas on which the population can occur (Schoener and Schoener 1983, Pimm et al. 1988). That smaller populations are more vulnerable to extinction is fundamental to Population Viability Analysis (Boyce 1992).

For PVA, estimating distribution and abundance of legally rare species must involve multiple spatial and temporal scales, the minimum spatial scale being the area encompassing a persistent, natural population or community, and the minimum temporal scale typically spanning ≥6 years (Cyr 1997). Smaller scales are unlikely to reveal spatial requirements. The largest scale considered should include the species' recent and current geographic range of distribution, so as to assess cumulative impacts and collateral take (losses). Estimates of population size and project impact due to foreseeable take must represent at least several generations of each species (for estimates of variance), and must account for dynamic spatial and temporal patterns (Hunsaker et al. 1990). Populations are typically clustered in space (den Boer 1981, Greig-Smith 1983, Hanski 1994), and these clusters tend to shift locations through time (Taylor and Taylor 1979). Furthermore, population density estimates decline with increasing spatial extent of study area, thereby requiring definition of density to spatial scale (Blackburn and Gaston 1996, Smallwood and Schonewald 1996). Extrapolating local population density estimates to larger geographic areas is inappropriate without adjusting the estimate down to include the inevitable space that is devoid of the species, often despite the apparent availability of habitat. When lacking data representing sufficiently large spatial and temporal scales, PVA parameter values should be very conservative.

In developing data for an ESA take decision, it is important to consider the cumulative impacts on the species due to other land conversion and water diversion projects, both those in the planning stages and those likely to arise as a normal outgrowth of economic development. To this end, an assessment must be made of projected land conversions in the species' range. Projections should be made of growth in human abundance and land conversions, as well as relevant demographic shifts. Specific plans of industry and government need also be addressed, and long range transportation and energy plans should be given high priority. Assessing cumulative impacts for ESA take decisions should be done much more rigorously and defensibly than is typical of its dismal use in many National Environmental Policy Act applications (McCold and Holman 1995).

At a minimum, the cumulative impact assessment should extend over the amortized life of the project or any permit duration. An assessment should also be made of how long facilities of the type under consideration generally last. In the case of a housing development, the projected lifetime is likely to be indefinite. Thus, in such a case, a cumulative impact assessment should extend to such a time that all unprotected land is converted due to development or resource extraction.

How was Risk Assessment and Impacts dealt with in the PALCO HCP and EIR?

A PVA was performed for the Marbled Murrelet, although there was no indication that the results were independently reviewed and published in a scientific journal. Estimates of the PVA parameter values were mostly qualitatively derived, and I doubt that the lower estimate of the difference between extant abundance and the carrying capacity of Murrelets was sufficiently conservative. The current Murrelet abundance could easily be less than 25% below carrying capacity on lands held by Pacific Lumber Co. SS-11

PVAs were not performed for any other List A or B species, but all these species should have been provided risk assessments because, now that they are proposed for take under an HCP/ITP, they are all treated as Threatened or Endangered under the ESA (Services 1996). SS-12

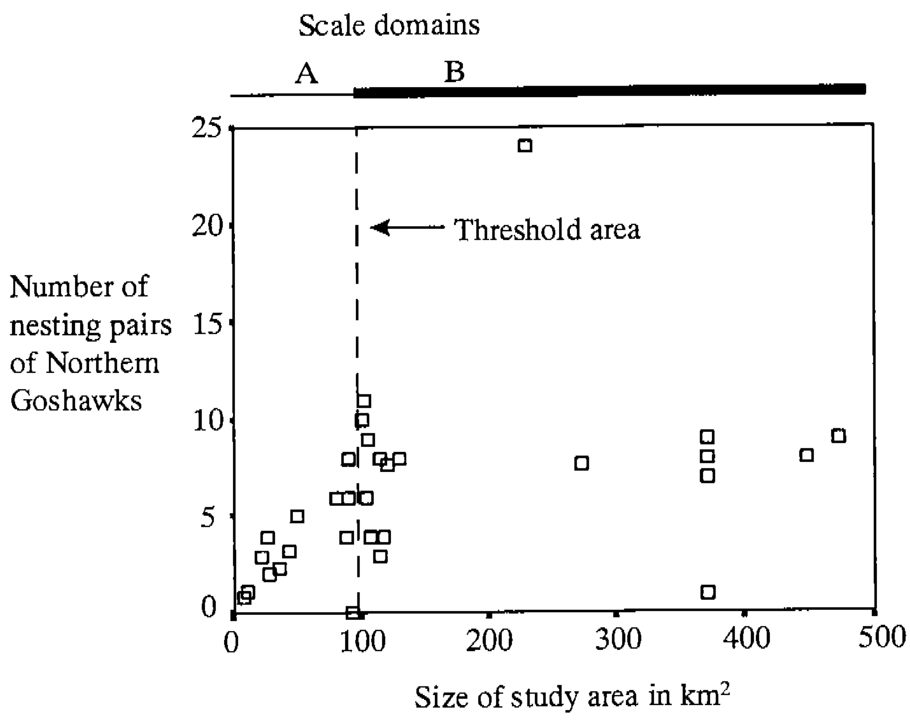
Many other species other than Marbled Murrelet will be negatively affected by the mitigation proposed in the Pacific Lumber HCP/SYP. Species that are dependent entirely or in part on late seral forests will also be restricted to the MMCAs following the proposed action, and many of the non-bird species will have difficulty traversing clearcut and selectively cut lands intervening the MMCAs. For most of these species, no scientific evidence exists to support the claim by Pacific Lumber that inter-patch connectivity will be provided by riparian buffers (HCP Vol. IV.E.D.2). Many of these species may be completely restricted to the MMCAs, unable to travel across the harvested landscape. For some of these species, reasonable estimates can be made of the number of animals that can be supported by the geographic area of each MMCA. Two approaches can be used, one based on typical home range sizes and degree of home range overlap among conspecifics, and the other based on spatial scale domains of abundance identified by plotting existing abundance estimates from the literature against the size of the study areas from which these estimates were made. In the absence of any estimates of take for species other than Marbeled Murrelets and Nortehrn Spotted Owls, I will use the identified spatial scale domains of abundance to estimate how many of each of the locally endemic Mammalian carnivore species and Northern Goshawk can occur within each of the MMCAs. My methods and results are described briefly in the paragraphs that follow. SS-13

Methods -- I used all the available, published estimates of seasonal and annual abundance of mammalian Carnivora, most of which were used by Smallwood & Schonewald (1996). To be included in my study, these estimates had to have been made from defined study areas based on defined research methods, and they could not consist of extrapolations from one site to another or from one site to a larger region.

For one species at a time, I plotted abundance estimates against their corresponding study areas, both of which were originally used for estimating densities. These plots included seasonal and annual estimates because I wanted to include all the natural variation in abundance that was reported. Examining these plots, I identified the largest estimates comprising a distinct domain of abundance, in which abundance no longer increased with increasing study area. These largest estimates were then removed from the next plot, when I also restricted the range of study areas from 0 km^2 to the largest area of the remaining estimates. The largest and most similar magnitude of the remaining estimates were analyzed in the same manner as the first group. This routine was repeated until the smallest magnitude estimates increased proportionately with study areas. Plots were examined with decreasing ranges of study areas so that discontinuities in abundance could be identified.

Results -- Distinct sequences of population estimates were identified from subsets of the available range of study areas among 30 species of Carnivora and for the Northern Goshawk. The population estimates typically increased in size as the study area increased until a "threshold area" was reached. Study areas smaller than the threshold area comprised scale domain A. The estimates made from study areas equal to or greater than the threshold area did not increase with increasing study area until another transitional study area was reached. Scale domain B included this range of study areas (e.g., see figure below). Above this second transitional area, the population size again did not increase with increasing study area until another transitional area was reached (scale domain C). Scale domains C and D were rare and more difficult to identify clearly.

SS-13 CONT.



Scale domain B comprised the range of study areas within which *populations* were likely studied. Acknowledging that species typically occupy only 20-25% of their range at any given time, and centers of activity tend to shift locations at least every generation or so (Taylor and Taylor 1979, Smallwood 1997), I multiplied the threshold area by 5 to estimate the minimum area needed to support a population of the species at any given time.

The following table lists the minimum areas likely to support a population of each species, assuming that about 20 to 25% of the species range is actually occupied at any given time. The following table also answers the question as to whether the MMCAs can support the particular species of Mammalian carnivore or the Northern Goshawk. Not all the species of Carnivores listed in the table are obligated to use late seral forest, and some of them might prefer other vegetation complexes, but they were included based on my knowledge of their avoidance or harm caused by clearcuts; that is, the proposed action will likely restrict these species largely to the MMCAs.

Species	Minimum area (km^2) likely to support a population	Is a population likely to be supported within:		
		the 860 km^2 PALCO holdings?	the proposed 30.6 km^2 Public Reserve?	the largest proposed MMCA of 9.3 km^2 ?
Accipiter gentilis Northern Goshawk	500	yes	no	no
Canis latrans Coyote	700	yes	no	no
Urocyon cinereoargenteus Gray fox	205	yes	no	no
Vulpes vulpes Red fox	445	yes	no	no
Puma concolor Mountain lion	6750	no	no	no
Lynx rufus Bobcat**	680	yes	no	no
Martes americana Marten	70	yes	no	no
Martes pennanti Fisher**	405	yes	no	no
Spilogale gracilis Spotted skunk**	145	yes	no	no
Mephitis mephitis Striped skunk	15.4	yes	yes	no
Mustela frenata Long-tailed weasel**	100	yes	no	no
Mustela errminea Ermine	31	yes	yes	no
Mustela vison Mink	163	yes	no	no
Taxidea taxus Badger	350	yes	no	no
Gulo gulo Wolverine	6500	no	no	no
Bassariscus astutus Ringtail**	225	yes	no	no
Procyon lotor Raccoon**	795	yes	no	no
Ursus americanus Black bear	960	no	no	no

SS-13 CONT.

** The minimum area was estimated from the allometric model derived from all the Carnivore species for which scale domain B could be identified ($R^2 = 0.72$, Root MSE = 0.43, df = 1, 21, $P < 0.0001$):

$$\log(\text{km}^2\ \textit{Threshold area}) = 1.62 + 0.64 \log(\text{kg}\ \textit{Female body mass}).$$

Based on the minimum areas needed to support populations of Mammalian Carnivores and the Northern Goshawk, PALCO's holdings can currently support one or more populations of all but 3 species listed in the above table. It likely includes portions of populations of mountain lions, wolverine (if they occur there), and black bear, although PALCO's holdings could conceivably support an entire black bear population. Should PALCO be permitted to clearcut according to project alternative 2, the available habitat of these species on and off PALCO's holdings may very well reduce to a spatial extent too small to continue supporting populations of mountain lions, wolverine, and black bears. According to the available abundance estimates in the literature, the proposed Public Reserve and the largest of the proposed MMCAs will fail to support a population of all species in the above table except the ermine and striped skunk. The proposed mitigation for the Marbled Murrelet will most likely prove inadequate for conserving most, if not all, of the Carnivore species and the Northern Goshawk on PALCO holdings. This is significant, because the takings of many of the list A & B species are claimed to be adequately mitigated within the MMCAs (HCP Vol. IV.E-F). Also, take of the marten is claimed to be mitigated by providing corridors in the riparian buffers, even though the HCP earlier acknowledged that scientific evidence is lacking as to whether corridors can perform the functions claimed by some conservation biologists (Vol. II.L, pages 3-4). Project alternative 2 was not analyzed adequately for its impact on the environment, which will likely be significantly catastrophic to the biological species. SS-13 CONT.

The same methods I used to assess the impacts of alternative 2 on Carnivores and the Northern Goshawk can and should be applied to the other species residing or potentially residing on PALCO lands. Impacts on these species should be estimated and risks to their continued survival assessed. Also, PALCO provided no impact assessment of Project Alternative 3 (EIR page 3.10-102), assuming that selective logging has no impact on animal species. Impacts were assessed based on changes in Habitat acreage, but silvicultural practices also vary in their impacts.

Cumulative impacts were not seriously assessed in the PALCO HCP, nor were there any adequate range-wide assessments of any of the list A & B species. Citing Kennedy (1997) as scientific foundation for concluding lack of range-wide declines in Northern Goshawk abundance was shown to be inappropriate (Smallwood 1998). Kennedy's (1997) conclusions were based on improper comparisons of data representing several variables. Smallwood (1998) agreed with most Goshawk experts that Goshawks are threatened most by habitat fragmentation, which in this case, is the continued loss and increasing isolation of remaining patches of mostly old-growth forest. SS-14

PALCO claimed that project impacts will be less than significant on some of its HCP list A & B species, due to unlikely or undetected occurrence of these species on the PALCO holdings. For example, PALCO included in its lists the wolverine, Northern Goshawk, and White-tailed Kite, even though these species were believed to not occur on PALCO holdings. On closer inspection, I found that PALCO considered wolverines to be associated with high elevation boreal forest, often in the absence of human activity (IV.F.B.4), and PALCO claimed the wolverine range does not include PALCO holdings. Well, the WHR range map depicts wolverine range right on the eastern boundary of PALCO holdings, and CDFG's Natural Diversity Data Base includes occurrence records of wolverine outside their range. In the vicinity of PALCO holdings, the wolverine occurrence records were mostly at low to mid elevations and in vegetation complexes other than boreal forest. Range boundaries should be treated conservatively, because species distribution patterns tend to grow more variable towards the range boundary (Taylor 1993). PALCO used inappropriate habitat descriptions for wolverine and were unjustified in concluding they are absent from PALCO holdings. SS-15

The natural history data for the White-tailed Kite were taken from 2 compendia on bird species, rather than from scientific sources, and the scientific and common names were four years out of date. Scanning the natural history descriptions of other species, I found similar, erroneous habitat descriptions and reliance on nonscientific source literature. The PALCO HCP and EIR cannot be relied on for assessing the proposed project impacts to these list A & B species. SS-16

PALCO ignored core ecological theory and empirical evidence when it relied on lack of occurrence data to conclude that project actions will have less than significant impacts on species. Rare SS-17 species populations often remain undetected for long periods. Also, as pointed out earlier in this comment, species populations are spatially dynamic. For example, Ingles (1965) presented a mountain lion range map that did not include a large portion of northeast California. My statewide track count for mountain lions corroborated Ingles' range map in 1985, 1986, 1992, and 1995 (Smallwood 1997). In 1998, I found track sets of mountain lions on nearly every transect length I have in this portion of northeast California (unpubl. data). Mountain lions recently moved into this area, although they declined substantially in abundance throughout the remainder of California where I had transects. Had previous absence of mountain lions lead to a policy change that permitted habitat fragmentation in northeast California, then we would never have learned of the value of this area to mountain lions. The same consideration must be given to PALCO's holdings when assessing the impacts and risks to the species claimed to be absent or of low abundance. SS-17 CONT.

Standard 3: Ecosystem Assessment

If the Services are to conserve the ecosystem upon which the listed species depend, then they must describe and assess the ecosystem for project impacts. Drawing from multiple ecosystem definitions (O'Neill et al. 1986, Blew 1996, Fauth 1997), I consider an ecosystem to be an open system with inputs, outputs, and recycling of energy and material resources through hierarchically organized biological interactions. Such a conceived system need not have geographic boundaries, but research and management goals often require them. The interactions between organisms and their environment that are key to any definition of an ecosystem require landscape structures that facilitate the movement of both raw and embodied energy and material resources through environmental media such as soil, water, and the atmosphere (Turner 1989). Conservation of an ecosystem requires protection of the landscape structure, its natural disturbance regime, the endemic biological community, and the levels of resource inputs that maintain its functionality (Ricklefs et al. 1984, Holling 1986). Its conservation also requires an effort to avoid disruption of its interactions and reductions of its resource assimilation efficiencies due to intrusion by invasive species, chemical pollutants, and physical barriers placed on streams and terrestrial landscapes (Rapport et al. 1985).

According to Karr (1994), ecosystem integrity is jeopardized by reduced capacity of the landscape to support biological communities with a species composition and organization similar to the region under natural hydrologic processes. Dams and other stream barriers change discharge and temperature regimes (Dynesius and Nilsson 1994), thereby encouraging exotic fishes and their replacement of native fauna (Moyle et al. 1986). Stream diversions for urban and agricultural uses reduce flow volumes and sediment deposition patterns, thus altering the distribution and spatial extent of riparian vegetation (Dynesius and Nilsson 1994). Upslope tree removal can also change sediment loading and runoff patterns, and can impede the daily and seasonal slope migrations of many faunal species. Given that <1% of the western US is covered by riparian vegetation, but up to 82% of the avian species breed in it at some locations (Knopf et al. 1988), alterations of its extent can have profound consequences on the avifauna (Croonquist and Brooks 1993). All these changes to stream flow regimes fundamentally change the ecosystem upon which species depend (Bedford and Preston 1988); their conservation is put at risk. Conserving ecosystems will be possible only if the effects of stream barriers, diversions, channeling, and chemical and nutrient inputs can be accurately described and dealt with in the context of the proposed additional land use changes (take).

As terrestrial landscapes are altered by the expansion of human activities, some native species lose their capacity to move across the landscape and interact, which is also critical for maintaining ecosystem integrity (Karr 1994). Fragmented habitats also fragment species' distribution patterns, and in combination with the resources provided by human activities, fragmentation provides opportunities for exotic species to invade (Smallwood 1994). Exotic species interact with local species, and possibly dilute their resource assimilation rates. ESA documents such as HCPs will have made no contribution to conserving ecosystems upon which listed species depend without addressing habitat fragmentation and the intrusive effects of invasive species.

Conserving ecosystems can be possible when ESA documents such as HCPs include assessments of the principal environmental media in which raw and embodied resources flow, are stored, and cycle through biological interactions. These principal media are water and soil (Ricklefs et al. 1984). The character of soil depends fundamentally on the regional geology, topography, and the past and current hydrology influencing inundation and sediment deposition patterns. The spatial patterns of these media and their associated biota determine terrestrial landscape structure, its change, and its function (Turner 1989). Through time, assemblages of biological species have adapted to the character and structure of these media on the landscape, such as riparian forests along major streams, vernal pools in seasonally inundated patches of clay soils, and grasslands on loam and sandy soils lacking seasonal inundation. Complex symbiotic relationships have developed among species that enhance the chemical characteristics of water and soil media so as to increase assimilation efficiencies and productivity (Maser et al. 1978, Ricklefs et al. 1984). Conserving ecosystems requires the conservation of their functional landscape structures and healthy water and soil conditions, especially those most often associated with rarity and listed species. Ecosystem conservation can be guided by known system stability principles (Watt and Craig 1986).

By requiring conservation of the supporting ecosystem of listed species, the intent of the ESA was clearly to leave the Services with no room for developing narrowly defined statutes to justify actions that would in any way jeopardize the goal of recovery. Like critical habitat designation, ecosystem assessments must be made at multiple scales because ecosystems are conceptually organized hierarchically (Klijn and Udo de Haes 1994), and are best examined from the top-down of the hierarchy (O'Neill et al. 1986, Bedford and Preston 1988). Also, ecosystems are not predisposed to convenient description within project boundaries, even though they are arbitrary assignments of the environmental elements into conceptual compartments. Assessing project impact on ecosystem function will likely differ in results according to whether done at the scale of the project area or the region.

A trend among HCPs has been to represent the status of multiple species and their habitats by a single "umbrella," "indicator," "flagship," or "keystone" species, the latter two representations being more implicit). For example, the status and take levels of 29 rare species were represented by the status of Swainson's hawk (*Buteo swainsoni*) foraging habitat in the Yolo County HCP (EIP Associates 1996). The status and take levels of 32 species were represented by the status of giant garter snake in the Natomas Basin HCP (US Fish and Wildlife Service (1997a). The status and take levels of 85 species were represented by the status of the coastal California gnatcatcher (*Polioptila californica californica*) in the San Diego Multi-species Conservation Program (Fed Reg. 62[60]:14938-41). the status and take levels of 48 animal species were represented by the status of Marbled Murrelet in the PALCO HCP. The scientific foundation is lacking for these and many other representations of multiple species and their habitats by a single species or a portion of its habitat (Morrison et al. 1992, Simberloff 1998). Such scientifically unfounded representations are contrary to using the best scientific data, pursuant to the ESA.

Assessments of ecosystem condition and likely project impacts require scientists who are trained in ecological theory and method with an emphasis on ecosystems. Assessments cannot be made without carefully integrating and aggregating the detail in many environmental elements comprising the ecosystem. Ecosystems are more reliably assessed using indicators of landscape structures and biological inventory that influence biological and physical transport and storage of material and energy (O'Neill et al. 1986, Bedford and Preston 1988). Ecosystem assessments can and should be made using carefully chosen and designed ecological indicators (Cairns and McCormick 1992, O'Neill et al. 1994) based on known relationships between anthropogenic pressures and their impacts (Karr et al. 1986).

Modern risk assessments of ecosystem function require use of indicators expressing sensitivity, vulnerability and impact (Rapport et al. 1985, USDA 1994). Sensitivity is the predisposition of the system to degrade due to changes in the conditions. Vulnerability is the likelihood of degradation when particular anthropogenic activities pressure the sensitive parts of the system. Impact is the consequence of the pressure to the system. Risk of project impacts on ecosystem function are now possible, at least in part, using GIS and landscape ecology (Turner 1989, Graham et al. 1991, Battaglin and Goolsby 1995), and the ecosystem indicators approach (Bedford and Preston 1988, Cairns and McCormick 1992, Rotmans et al. 1994, Schulze et al. 1994). Using this approach, sensitive and vulnerable parts of the ecosystem can be identified and mapped along with the pressures (Smallwood et al. 1998), and these maps can be compared to maps of realized impacts for validation (Karr et al. 1986, Zhang et al. 1998). These modern assessment methods must be used to conserve the ecosystems upon which the listed and other species depend. Just stating that the ecosystem will be conserved by reserve establishment or other types of mitigation is inadequate for decision makers.

<u>How was Ecosystem Assessment dealt with in the PALCO HCP and EIR?</u>

The PALCO HCP and EIR did not use an ecosystem approach to analysis and assessment of consequences due to the proposed project alternatives. An ecosystem was not described for the PALCO holdings. There was no diagram depicting the major environmental elements in the area, the flow pathways of energy, nutrients and other materials, and the quantities of energy and matter stored in biomass or physical media. There was no ecosystem model of any kind, nor were there any estimates of raw and embodied energy and material resource inputs, outflows or storages. There was no assessment of ecological integrity or levels of biological invasiveness of the various Habitats. Symbiotic relationships, such as between soil organisms, fungi and plant roots, were not described or represented in any estimates of project impacts. The landscape was not described in terms of its structure or functionality. The PALCO HCP was prepared in the absence of an ecosystem assessment or any assessment of risks to the ecosystem due to the preferred and rejected project alternatives. How then can PALCO, the CDFG, and the Services conserve the ecosystem upon which the list A & B species depend? SS-18

The HCP takes, on the one hand, an ecological shortcut in representing the habitats of many species with the habitat of Marbled Murrelet. As pointed out earlier in my comment, this approach was inappropriate. On the other hand, the HCP considers its mapped Habitats as independent entities with no ecological linkages among them. For example, the EIR argues that all project alternatives would not be expected to substantially decrease or degrade riparian habitat conditions (page 3.10-103), as if the riparian environment is somehow independent of environmental conditions beyond 170' of the stream. Such a view lacks any foundation in ecology (Margalef 1963, Ricklefs et al. 1984). SS-19

The HCP and EIR assesses impacts on mapped Habitat Types and list A & B species based on projected changes in acreage (page 3.10-99), rather than based on known or estimated ecological impacts. The EIR comparison of alternatives failed to systemically consider the impacts of cleared space on rainfall patterns, erosion rates, sediment loading, invasiveness of remaining patches, loss of symbiotic relationships, and so on. SS-20

Standard 4: Adaptive Management

Adaptive management is an approach to management that acknowledges uncertainty and the need to learn (Holling 1978, Walters 1986). The term "adaptive" refers to managers learning about systems as they attempt to manage them. Recently, Lancia et al. (1996) described the core failures of managers to properly implement adaptive management. They noted that managers typically base their decisions on intuition and experience, and contend that enough is known to proceed with management. To make matters worse, when the need for quick action is perceived, solutions may be implemented in ways that make it difficult to evaluate what was done (e.g., no or inadequate replication and controls). adaptive management offers a potential solution to these dilemmas by encouraging research and management to be conducted simultaneously as one coordinated effort. Adaptive management is not equivalent, however, with trial-and-error approaches that recognize error and then apply some *post hoc* remedial action. adaptive management requires that sound management experiments are planned prior to implementation of a plan. adaptive management then permits administrators and managers to hedge their bets because they can consider several different models simultaneously. Costly problems, unforeseen when management is initiated, may be discovered. Thus, higher short-term costs should be recouped over the long term.

Adaptive management incorporates the ecological indicators approach, described earlier under ecosystem assessments as one of multiple steps towards achieving a range of alternative objectives (Holling 1978, Walters 1986). The first step involves the formulation of a clear set of alternative objectives, and step two involves designing effective policies to achieve them. Adaptive management then involves the generation of relevant indicators for decision-making, evaluation of each policy in terms of the spatio-temporal behavior of the indicators, synthesis of indicator information for screening of the most important policies, and communication among the staff, decision-makers, and citizens for policy formulation. According to Haney and Power (1996), the essential steps in any project developed around adaptive resources management are to: (1) compile all existing data; (2) develop project goals; (3) develop working hypotheses; (4) implement the prescriptions; (5) monitor results; (6) evaluate and test monitoring data, and (7) return to step #3. Either way of looking at it, adaptive management is a structured process designed to incorporate learning about the managed resources through management actions that enable hypothesis testing, much like the description provided in the HCP Guidelines (Services 1996).

Halbert (1993:262) noted that the original intent of adaptive management was to apply "experimentation to the design and implementation of natural resource and environmental management policy." adaptive management is not an excuse to follow a trial-and-error or wait-and-see approach. It requires a rigorous, biologically and statistically valid approach. McLain and Lee (1996) noted that an essential element of adaptive management was development of a model to simulate key relationships among components of the system being managed. This model is used to test a range of hypotheses and identify those policy options likely to achieve management objectives.

Following stake-holder meetings, adaptive management should proceed with the design of replicated and interspersed treatments, including controls, at a meaningful, large scale (Lee 1991, Simberloff 1998). As hypotheses are tested, the results are supposed to be transmitted to the involved policy-makers and other stake-holders so that the most appropriate of multiple objectives can be targeted for new management prescriptions. However, even the best-known attempts at implementing adaptive management have suffered fundamental shortfalls (McLain and Lee 1996). Adaptive management is encouraging in its use of experimentation and monitoring to reduce uncertainty in system behavior under management (Haney and Power 1996, Lancia et al. 1996), but the approach requires careful application.

How was Adaptive Management dealt with in the PALCO HCP and EIR?

The only specific objectives for adaptive management detailed in the PALCO HCP were stream attributes referred to as Habitat Condition Goals. A flow chart (fig. 6, vol. IV, Part D.2.1) depicted the proposed scheme for implementation of adaptive management, involving agency consultation when habitat condition goals are not being met, and it remains unclear how agency consultation will have any influence over PALCO, given the No Surprises Assurance.

The list A & B amphibians and other aquatic species will be subject to the same adaptive management process as the aquatic habitat condition goals, although no specific thresholds or actions were described for these species. The Scientific Advisory Panel recommended that adaptive management of the Marbled Murrelet not be implemented in the HCP because they concluded the mitigation was front-loaded in the MMCAs and no changes in management could be foreseen to benefit Marbled Murrelet. Similarly, PALCO included no adaptive management prescriptions for all of the other List A & B species other than the inclusion of aquatic species under the rubric of aquatic habitat condition goals. PALCO not only misunderstood adaptive management, but has no plan to implement adaptive management for the majority of List A & B species. The No Surprises Assurance would negate any requirement for PALCO to manage adaptively, anyway.

SS-21

Lacking adaptive management, and possessing the Assurance of not having to adapt management to unforeseen circumstances or new scientific information, the PALCO HCP will have no scientific foundation. The ITP would lock in forest management based on the inadequate and biased natural history information that PALCO has presented in its HCP.

Standard 5: Monitoring for Impacts and Mitigation Success

Monitoring for rare species is difficult, and requires a detailed, rigorous design. Sampling to detect trends in rare animal species requires special sampling designs and analytical techniques (Gerrodette 1987, Green and Young 1993). Nevertheless, these methods are now well published and available in scientifically reviewed books (Heyer et al. 1993, Sutherland 1996, Wilson et al. 1996, Morrison et al. 1992). Sampling and design considerations for inventory and monitoring of multiple forest resources were detailed recently by Morrison and Marcot (1995).

A broad range of conceivable take, mitigation, and conservation impacts need to be considered, particularly for applicants seeking take of multiple listed species. However, the conceivable impacts do not always match the realized impacts. Therefore, adequate, scientific monitoring needs to be implemented along with an adaptive management strategy that details adaptive management practices to be implemented when monitoring reveals particular impacts (HCP Guidelines, Services 1996). Monitoring of the legally rare species and functionally important ecosystem conditions (indicators) needs to be conducted at a spatial scale large enough to detect meaningful patterns of change through time. Meaningful patterns of change will be those informing of likely impact. The monitoring also should be adequate for conducting power analysis (Gerrodette 1987; Morrison et al. 1992). Monitoring for impacts should rely more on preventing Type II errors than Type I errors (Shrader-Frechette and McCoy 1992). If the null hypothesis is that the population (or ecological indicator) has not changed through time, while the alternative is that the population has declined, then rejecting the null hypothesis when it is actually true will lead to the false but conservative conclusion that the population is declining. On the other hand, by not rejecting the null hypothesis when it is actually false, action will likely not be taken to adapt management for halting the decline of the population. Concluding lack of statistical significance based on, for example, a >5% chance of committing a Type I error, does not translate into lack of impact.

Monitoring measures were fairly well described in the federal HCP Guidelines (Services 1996). Scientific monitoring for impacts due to implementation of HCPs and Agreements should be described in the planning and take authorization documents. Appropriate goals and standards should be detailed for implementation of adaptive resources management practices.

How was Monitoring dealt with in the PALCO HCP and EIR?

The monitoring study implemented in 1995 lacks a scientific design. The main areas where plots were located appeared to be chosen based on the convenience of having paved roads. The sampling did not represent the full east-west or north-south extents of the PALCO holdings, nor did it equitable represent the vegetation assemblages termed "habitats." To do so would have required random or systematic plot selection across the PALCO holdings.

I was uncertain from the HCP and EIR whether the 1995 monitoring study was being proposed as the official HCP monitoring of impacts and mitigation success. If so, then it is fundamentally flawed. If not, then the PALCO HCP lacks any defined monitoring plan and fails to comply with the federal HCP guidelines (Services 1996).

SS-22

According to the US Fish and Wildlife Service Guidelines on Habitat Conservation Plans (Services 1996), monitoring programs are essential for assessing the real impacts to the species and the success of the mitigation. In fact, the Guidelines call for monitoring to be integrated into an Adaptive Management program, whereby monitoring thresholds are supposed to result in action(s) to rectify any surprising, deleterious trends. Pacific Lumber has yet to seek advice on how to design their monitoring program, and they state clearly in the Habitat Conservation Plan that consultation with the US Fish and Wildlife Service and California Department of Fish and Game will be advisory only. This Habitat Conservation Plan offers no monitoring, no thresholds or action plans for surprises, and no need for responding to the advice offered by the government should the species appear to require more effective mitigation. I assume that PALCO is acknowledging that under the No Surprises agreement, the agencies will be obliged to act on any deleterious surprises revealed by the monitoring, so long as the agencies can get the congressional allocations to do so.

Standard 6: Uncertainty analysis

To be scientific, data must contain an assessment of its uncertainty. If one uses data to develop a PVA or other quantitative combination of data, uncertainties should be propagated through to the final calculation of interest. Uncertainty distributions can be assigned to each parameter and the resulting output distribution computed. Monte Carlo techniques can be useful for this purpose (US EPA 1996). When data in the literature on a parameter is limited, risk analysts normally fit the data to an uncertainty distribution with long tails, such as a log normal distribution, to avoid excluding low and high values from the analysis.

Sometimes professional judgment is necessary to fill data gaps or extrapolate data to the current situation. It is inadequate to hide professional judgment in phrases, such as "it is believed that." These terms reflect an implicit, subjective probability assessment on the part of the analysts. Analysts should quantify the confidence and uncertainty range to be attached to these subjective probabilities. The use of expert judgments and subjective probability has been studied at length in human risk assessment (Cooke 1991, Morgan and Henrion 1990, US EPA 1996), and in developing clinical trials in medicine (Berry and Stangl 1996). Both the methodology and lessons learned from these fields should be applied to ESA analyses. Some of these lessons are: (1) Expert assessments can suffer from clustering and poor calibration; (2) An elicitation from a set of experts is to be preferred to the judgment of an individual; (3) Expert views should be used to develop a broad subjective probability distribution for uncertain parameters, rather than be used as point data; (4) Experts tend to be overconfident in predicting events at low probability; (5) Policy pressures can influence the judgment of experts or lead to their assessments being ignored (Cooke 1991).

For toxic tort litigation in US courts, uncertainty analysis is required for the admissibility of scientific expert testimony, which also cannot consist of unsubstantiated speculation (William Daubert and others, Petitioners v. Merrell Dow Pharmaceuticals, Inc., No. 92-102, Supreme Court of the United States). Although it remains to be seen whether the Daubert decision applies to ESA compliance issues, its requirements are consistent with the ESA intent of using the best scientific data. Scientific testimony in ESA documentation needs to be founded on the best scientific principles and methods, as described earlier, and sources and magnitudes of uncertainty need clear description.

Uncertainty analysis should be routinely applied to critical habitat designation, to PVA for assessing risks to survival and recovery, to ecosystem assessments, and to monitoring results for use in adaptive resources management. In assessing habitat and ecosystem conditions, the spatial data in GIS maps need to be analyzed for error rates at least in part by conducting ground-truth surveys (verification analysis) and iterative re-assignment of derived values per land unit (sensitivity analysis). Using modern research methods, an accuracy assessment with error rates can be applied to predicted species' ranges based on habitat designations and vegetation and landform maps, thereby meeting ESA requirements, biological reality, and U.S. court standards. Uncertainty in the estimates of project and cumulative impacts can then be characterized and reduced using simulations.

Error rates should accompany PVAs, as well as the parameter value estimates such as population abundance, reproductive rates, and dispersal distances. These error rates must be attributed to sources such as variability in the data (uncertainty analysis) and measurement error. The same is needed of the indicators used in ecosystem risk assessments, and it has already been demonstrated using the Index of Biotic Integrity for assessing stream resources (Fore et al. 1994). An honest description of all the sources of uncertainty and model limitations must be represented (Rejesky 1993). Uncertainty ranges will sometimes require expert guesses, but when done this way, the rationale should be provided for the ranges provided. Using modern scientific standards, a PVA can be accomplished to satisfy the level of assessment rigor needed to qualify it as the best scientific data, pursuant to the ESA and justified by the stakes at issue.

<u>How was Uncertainty dealt with in the PALCO HCP and EIR?</u>

PALCO has introduced overwhelming uncertainty into their HCP and EIR. Habitat was defined and used incorrectly throughout the HCP and EIR, and the habitat types fail to represent the habitat of the individual species – no habitat analyses were actually performed. No ecosystem analysis was performed. Natural history data were poor for all species except Northern Spotted Owl. Habitat guilds were constructed using multiple methods, at least one of which was not explained. Pocket gophers, California ground squirrels, black rats, brown rats, and house mice were all declared habitat generalists and were placed in a common guild, contrary to the conclusions that should have been made based on a wealth of scientific knowledge available for these species. No consideration was given to the typically devastating response of pocket gopher populations to clearcuts and subsequent seedling regeneration (Smallwood in press). Uncertainty abounds as to the specific impacts of the proposed project to species, and virtually all impact estimates lack realistic uncertainty ranges. The FREIGHTS model projections were based on SS-23 many assumptions, many of which were likely erroneous. Where was the uncertainty in the GIS maps depicting habitat distributions in 10, 35, 65, and 105 years from now. As attractive as these maps may be, they are not scientifically founded, having been constructed from flawed definitions of habitat and subjected to no sensitivity analysis. SS-23 CONT.

Standard 7: Referencing of Source Data

To comply with the ESA's intent of using the best scientific data, referencing the sources of scientifically based conclusions must always be included in planning and take-authorization documents, whether these documents were prepared by environmental consultants or the Service's Section 10 support staff biologists. Document writers are not being scientific when they use phrases such as "it is believed that." without any reference to the source of such belief. It is believable when the source of the belief is provided along with an uncertainty range or confidence interval. Referencing will be more scientifically defensible and useful when the following standards are met: (1) Preference given to empirically-based reports, reviews of empirical reports, and scientific principles; (2) Balanced or comprehensive use of data analyses, scientific ideas, and anecdotal evidence supporting different sides of an argument, rather than tactical, selective referencing; and (3) Accurate representation of referenced scientific research reports or published opinions. Standard protocols for referencing in scientific document preparation are described in numerous books, papers, and scientific journal guidelines to authors.

Until proper referencing has been recognized to qualify scientific and commercial data as the best available, planning and mitigation for take of legally rare species will be unlikely to comply with the intent of the ESA.

How was Source Referencing dealt with in the PALCO HCP and EIR?

The EIR contained numerous citations, all of which lacked any references describing the title of the publication, the publication outlet or any other information useful for locating the source material. The EIR looked like it had some foundation with citations, but I had no way of confirming the conclusions without detailed references enabling me to locate the material. SS-24

Much of the citing in the HCP was of unpublished reports or natural history compendia, not worthy of the scientific foundation needed to explain why PALCO can conclude that their proposed project will have less than significant impacts on the species and the environment.

Standard 8: Independent Scientific Review

Scientific research results are usually subjected to peer review. If not, then they are published in what scientists refer to as the "gray literature." Scientists find value in gray literature where expedience in publication is useful, or where the author is targeting a select audience. However, scientists usually prefer to rely on peer-reviewed research results for building their theory. Some scientific journals require reference only to peer-reviewed research results. Peer review is an important quality of scientific research that keeps the process credible (Woolf 1981, Heath 1989) and effective.

Because the ESA requires use of the best scientific data in biological assessments and HCPs, independent scientific review should be a standard step preceding the issuance of any take-permit. Public review periods do not constitute independent scientific review, just as scientists do not obtain independent peer review by making their draft manuscripts available to the public. Rather, scientists solicit peer review, and usually the process is administered by professional editors. Without independent review, modern science cannot work. If this academic peer review process is slower than pragmatism will tolerate, then independent scientific review can be obtained in other ways. For example, although not yet in existence, professional editors of environmental assessment documents could designate reviewers in advance of the assessments and their documentation. Using this approach, the consultants or the Services support staff biologists would also know in advance that their work is going to be reviewed, which by itself would ensure better work.

Independent scientific review should be standard and mandatory of HCPs and other biological assessments used to justify issuance of take-permits. With so much at stake in the government's issuance of take permits, especially the Headwaters forest, the supporting science is in greater need of independent review than is academic science. Not only are biodiversity and ecosystem functionality at stake, but also legal integrity, allocation of public funds, the public trust, and the integrity of the environmental sciences. Environmental consultants and the Services' support staff biologists should not only be required to obtain independent scientific review, but they also should be expected to eventually publish their assessments in professional, scientist-reviewed outlets (National Research Council 1986). Making such reviewed publications routine would help prevent errors and scientific fraud in its several forms (Woolf 1981, Chubin 1985). Sufficient detail of the research should be published to facilitate replication of the research (Chubin 1985), and raw data should be kept available for independent scientific review.

Independent scientific review would greatly improve the public's confidence in assessments and HCPs developed by environmental consultants, who usually are hired by the take-permit applicant. The environmental consultants have a vested interest in pleasing the take-permit applicant, so these consultants are vulnerable to bias. The Services and local government agency biologists should not serve as independent scientific reviewers, because they must issue the permits and oversee the plan's implementation -- they are not independent from the projects under consideration, and could conceivably be biased. By implementing independent scientific review, the process would become more open and consistent with democratic ideals.

<u>How was Independent Review dealt with in the PALCO HCP and EIR?</u>

Data were collected, analyzed, and used to found the PALCO HCP. These data should have been subjected to independent scientific review, as described above. They were not. After having reviewed many papers submitted to professional journals, and after having served as Associate Editor of Biological Conservation, I feel confident in predicting that the Multiple Species Monitoring Study would experience great difficulty in getting favorable reviews from independent scientists. The sampling methods lacked rigor and the design was not scientific. The cluster analysis was inappropriately applied to those data, and the results were taken too far in assigning species to habitat guilds. The data collected in the Multiple Species Monitoring Study were not the best available scientific data, because they were not designed to be scientific and they were not treated scientifically once they were collected. SS-25

Furthermore, the Marbled Murrelet PVA and the sampling efforts for Northern Spotted Owl should be reviewed by independent scientists before being regarded as scientifically adequate.

No Surprises

The No Surprises Assurance Agreement is antithetical to the ESA because it precludes adaptive management, science, and proper function of the HCP/ITP, especially in light of the take proposed by PALCO in its HCP. By providing PALCO with this Assurance, the Services and CDFG would: (1) conclude that the PALCO HCP/ITP is functioning properly; (2) rely on faith that today's available scientific information, as applied to the HCP/ITP agreement leading to the issuance of the ITP, will remain the best into the future; (3) forego adaptive management, which appears to be regarded as a critical tool by the Services (Federal Register 62(60):14940), and which has some legal foundation (ESA Section 2(b)); (4) disregard a large body of scientific evidence, along with the professional opinions of many scientists, that surprises are inherent in the distribution and abundance of both common and rare species (Connell 1978, Grossman *et al.* 1982, Belovsky *et al.* 1994), and indeed, in nature generally (Prigogine and Stengers 1984). The No Surprises Assurance offered to PALCO is especially egregious because: (1) the core scientific data are flawed, resulting in misleading habitat maps and habitat assessments; (2) the take will remove most of the late seral forest; and, (3) and the mitigation will fail to conserve many of the animal species using PALCO's holdings.

I am not alone in my condemnation of the No Surprises Assurances. Many scientists and other environmental professionals foresee the demise of science in playing any role in the take decisions pursuant to the Endangered Species Act. Many of these professionals co-signed a letter with me, which was submitted to the Services on July 26th, 1997. I have attached this letter for your consideration.

Summary

The term *habitat* was misunderstood by those who prepared this Habitat Conservation Plan. It was inappropriate for Pacific Lumber to analyze habitat from categories of timber stands that were convenient for mapping and for their 120-year Sustained Yield Plan. So called "habitat-based guilds" are *scientifically* nonsensical. Habitat should be defined by the species' *use* of the environment, based on a set of methods that are well known to wildlife scientists.

Habitat is unique to each species, so separate habitat analyses and mitigation strategies are needed for each of the 48 "covered" species. Pacific Lumber should have hired ecosystem ecologists to conduct the appropriate analysis. Habitat and ecosystem analyses are missing from this Habitat Conservation Plan.

Pacific Lumber lacked any empirical scientific foundation for narrowing the focus of the Habitat Conservation Plan from 48 species to a few, or really, to only one. Mitigation for the take of Marbled Murrelet should not be considered adequate mitigation for the take of Bald Eagles, Northern Goshawks, Bank Swallows, or Western Snowy Plovers. It was unscientific for Pacific Lumber to use Marbled Murrelets to represent the needs of nearly all the legally rare species in the Headwaters forest. SS-26

Pacific Lumber proposes to mitigate for their destruction of rare species and their habitats by donating a small fraction of the forest to the government and by maintaining Marbled Murrelet Conservation Areas. Nothing is being added by these conserved areas. All I see is a substantial *net loss* in habitat areas for these species, which must translate into increased risk of extinction based on the tenets of conservation biology. According to the language in the Endangered Species Act, cumulative impact assessments and risk assessments should be performed for each of the 48 species proposed for inclusion on the take permit. Such assessments have not been performed here.

Many scientific investigations have provided strong theory and method in identifying critical habitat designations, ecosystem assessments, risk assessments, environmental monitoring and adaptive resources management. Proper application of these methods help qualify data as the best, scientifically. PALCO has failed to maKe proper use of these principles and methods. After reading the Headwaters Habitat Conservation Plan, I am embarrassed as a scientist. This Habitat Conservation Plan makes a mockery of science. Pacific Lumber should have provided the Services with the best scientific data, analysis and interpretation. The stakes are too high to justify issuing PALCO a take permit for its HCP without having used the best scientific data.

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Re: Pacific Lumber Company Application for Incidental Take Permit, Habitat Conservation Plan and Sustained Yield Plan, Draft Environmental Impact Statement/Environmental Impact Report; Permit numbers PRT-828950 and 1157 and SYP 96-002

REFERENCES IDENTIFIED IN COMMENTS SUBMITTED BY SHAWN SMALLWOOD

ATTACHED   1 of 2

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July 26, 1997

Re: Fed. Reg. Vol. 62, No. 103, pp. 29091-29098 and No. 113, pp. 32189-32194 -- Proposed "No Surprises," "Safe Harbor," and "Candidate Conservation Agreement" rules, including permit-shield protection provisions

We hereby declare to the National Marine Fisheries Services, and the US Fish and Wildlife Service (hereafter referred to as the Services), as well as to the US Departments of Commerce and the Interior, that we are opposed to the proposed rules termed No Surprises, Safe Harbor, and Candidate Conservation Agreements including the permit-shield provision. Furthermore, we disapprove of any rule that would give Incidental Take Permit (ITP) holders general assurances that they need not comply with the Endangered Species Act (ESA) should unforeseen, changed, or extraordinary circumstances arise. Such assurances given to the holders of ITPs contradict the survival and recovery assurances given to the threatened and endangered species by the ESA. By implementing the referenced proposed rules, the Services would:

- prematurely and erroneously conclude that the Habitat Conservation Plans (HCPs) and Candidate Conservation Agreements are functioning properly;

- rely on faith that today's available scientific information, as applied to the HCP/ITP and Agreement, will remain the best into the future;

- forego adaptive management, which is regarded as a critical tool by the Services (Federal Register 62(60):14940), and which has legal foundation (ESA Section 2(b));

- disregard a large body of scientific evidence, along with the professional opinions of many scientists, that surprises are inherent in the distribution and abundance of both common and rare species, as well as in our interpretation of nature generally;

- disregard the body of scientific evidence that translocations of biota or their habitat to provide Safe Harbor will most often fail to conserve that biota, and may, in fact, cause further harm to biota in the area receiving the translocation.

These ramifications of implementing such assurances rules and provisions to the ITP-holder indicate to us that, not only will the ESA be seriously degraded, but also that science was inadequately used to guide the Services in preparation of these proposed changes to the ESA. The most rigorous scientific standards must be involved in HCP/ITP preparation from start to finish. The advances made in the last ten years

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clearly demonstrates the need to allow new scientific findings and adaptive management practices to be applied to HCP/ITPs. Re-opener clauses are necessary in the HCP Implementing Agreement to ensure the survival and recovery of species in the wild. Such a re-opener clause is especially important given the extent of land conversions involved in the HCP/ITPs and the history of scientific standards not being adequately applied to conservation and mitigation planning for issuance of HCP/ITPs.

The proposed rules and provision would assure the ITP-holder of no further ESA compliance obligations so long as the permit-holder has adhered to the terms of a properly functioning HCP. However, these terms and their proper function are based on contract agreements between the Services and the ITP-holder, which in turn are based on conclusions of the environmental consulting industry and the Services' Section 10 support staff biologists. Neither the Services nor the environmental consultants are without undue influence, economically or politically, which may lead to conflicts of interest in the outcome of species conservation. The scientific standards mandated by the ESA (i.e., best scientific information), but often overlooked in the planning process, include:

- Risk assessment (Population Viability Analysis, or PVA) of project impact(s) on the ability of species to survive and recover in the wild, thereby requiring certain details of population distribution, temporal dynamics, and demography of each species;

- Identification and designation of critical habitat on and beyond the project site;

- Ecosystem assessment conducted at a functionally relevant scale by scientists professionally trained in ecosystem ecology;

- Detailed explanation of intended adaptive management practices, along with a description of the conceivable types and magnitudes of changes in environmental and social conditions and species' status;

- Independent scientific review of the data, analyses, and biological assessment/opinion used to justify the HCP/ITP and Agreements. Most scientific research results are reviewed by independent peers prior to publication. The science used to justify an HCP/ITP or Agreement should also be independently reviewed by scientists prior to approval.

By failing to meet the modern scientific standards relevant to species and ecosystem conservation, most if not all HCPs/ITPs have not been based on the best scientific information available. Therefore, the Services are proposing to implement the proposed No Surprises and Safe Harbor rules to HCPs/ITPs that are already legally and functionally deficient.

Conventional environmental mitigation already exacerbates the conditions predisposing surprises in legally rare species conservation. Mitigation impacts predisposing surprises include the following:

- Cumulative habitat loss and habitat fragmentation due to the incidental taking and other human activities;

- Frequent failure of translocations of individual organisms or their habitat away from the project sites;

- Inadequate species accounts on project sites, thereby excluding some legally rare species from mitigation and conservation planning;

- Absence of uncertainty analysis or risk assessments performed for impacts of the HCP/ITP;
- Absence of adequate buffers or other stabilizing design features planned for mass mortality or habitat loss due to natural catastrophes on and around the mitigation lands.

Until these impacts and mitigation failures are corrected by ITP-holders and the Services, the take associated with the HCPs and agreements will continue to surprise conservationists and the Services with decline and extinction of species' populations. The proposed rules would greatly increase the risk of extinction of rare, threatened and endangered species in the wild.

We strongly recommend that the Services not implement the proposed No Surprises and Safe Harbor rules, nor the permit-shield provision. These assurances are not only inapplicable to the HCP process in general, but they are contrary to the conservation assurances provided to the species by the ESA. The Services have no other acceptable alternatives but to refrain from providing assurances to land holders who apply for HCP permits, nor have we been convinced by any evidence that ITP applicants and holders require such assurances. Based on our experience and scientific knowledge, we do not believe the No Surprises assurances are applicable to any species in the United States, let alone to those supposedly "covered" by a section 10(a)(1)(B) permit. We are strongly opposed to the permit-shield provision and to the proposed regulatory changes to 50 CFR Parts 13, 17 and 222. The proposed rules and permit-shield provision are antithetical to the Endangered Species Act because they preclude application of the best scientific information and adaptive management to species conservation, while also shutting the door on citizen participation in HCP/ITP decisions and enforcement of ESA requirements through legal actions.

For further information on our points made in this letter, please consider the attached paper, entitled "Science missing from the no surprises policy," authored by Dr. Smallwood with assistance from many of the co-signers of this letter.

Signed,

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Experience:

- 62 professional publications, 30 peer-reviewed
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- 39 public presentations of research results at professional meetings

Part-time Faculty, 1/98 to present, California State University, Sacramento. I've taught Ornithology Lab and Mammalogy.

Systems Ecologist, 7/96 to present, *Consulting in the Public Interest*. I am part of a multi-disciplinary consortium of scientists who facilitate large-scale, environmental planning projects and litigation.

Systems Ecologist, 1/95 to present, *Institute for Sustainable Development*, The Thoreau Center for Sustainability–The Presidio, California. I head ISD's program on integrated resources management. I develop indicators of ecological integrity for large areas, using remotely sensed data, local community involvement and GIS.

Ecologist, 1/97 to present, *Western Foundation of Vertebrate Zoology*. I conducted field research to determine the impact of past mercury mining on the status of the red-legged frog in Santa Clara County, California.

Associate Editor, *Biological Conservation*, 9/94 to 9/95. Administered peer reviews of submitted, professional papers in ecology and conservation biology, and made recommendations to the Editors. Have since rotated back to the Editorial Board.

Projects

Mercury effects on Red-legged Frog. Assisted Michael Morrison and US Fish and Wildlife Service in assessing the possible impacts of Santa Clara County's historical mercury mining on the federally listed red-legged frog. Also measured habitat in numerous streams.

Opposition to proposed No Surprises rule. Wrote a white paper and summary letter explaining scientific grounds for opposing the incidental take permit (ITP) rules providing ITP applicants and holders with general assurances they will be free of compliance with the Endangered Species Act once they adhere to the terms of a "properly functioning HCP." I obtained 188 signatures of scientists and environmental professionals on the letter submitted to the US Fish and Wildlife Service and the National Marine Fisheries Service. The letter was also provided to all US Senators. It helped change the prevailing view of HCPs as beneficial to listed species.

Natomas Basin Habitat Conservation Plan alternative. Designed narrow channel marsh to increase likelihood of survival and recovery in the wild of giant garter snake, Swainson's hawk and Valley Elderberry Longhorn Beetle. Design included replication and interspersion of treatments for experimental testing of critical habitat elements. Provided report to Northern Territories, Inc.

Cook *et al.* v. Rockwell International *et al.*, No. 90-K-181 (D. Colorado). Providing expert testimony on the role of burrowing animals in affecting the fate of buried and surface-deposited radioactive and hazardous chemical waste at the Rocky Flats Plant, Colorado. Provided expert report based on three site visits and the most extensive document review of burrowing animals ever conducted. Conducted transect surveys for evidence of burrowing animals and other wildlife on and around waste facilities. Discovered substantial intrusion of waste structures by burrowing animals.

Hanford Nuclear Reservation Litigation. Providing expert testimony on the role of burrowing animals in affecting the fate of buried radioactive waste at the Hanford Nuclear Reservation, Washington. Provided two expert reports based on three site visits and extensive document review. Predicted and verified population density of pocket gophers on buried waste structures, as well as incidence of radionuclide contamination in body tissue. Conducted transect surveys for evidence of burrowing animals and other wildlife on and around waste facilities. Discovered substantial intrusion of waste structures by burrowing animals.

Assessment of Environmental Technology Transfer to China, and Assessment of Agricultural Production System. Twice traveled to China and interviewed scientists, industrialists, agriculturalists, and the Directors of the Chinese Environmental Protection Agency and the Department of Agriculture to assess the need and possible pathways for environmental clean-up technologies and trade opportunities between the US and China. Spent a total of five weeks in China, including in Shandong and Linxion Provinces and in Beijing.

Yolo County Habitat Conservation Plan. Conducted the landscape ecology study of Yolo County to identify the priority land units to receive mitigation so as to most improve the ecosystem functionality within the County from the perspective of 29 legally rare species of wildlife. Used a hierarchically structured indicators approach to apply principles of landscape and ecosystem ecology, conservation biology, and local values in rating land units. Derived GIS maps to help guide the conservation area design, and then I developed implementation strategies.

Mountain Lion Track Count. Developed and conducted the carnivore monitoring program throughout California since 1985. Species counted include mountain lion, bobcat, black bear, coyote, red and gray fox, raccoon, striped skunk, badger, and black-tailed deer. Vegetation and land use are also monitored.

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